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10/800,829	03/15/2004	Newton G. Petersen	5150-65801	1380

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EXAMINER
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HUISMAN, DAVID J

ART UNIT	PAPER NUMBER
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2183

MAIL DATE	DELIVERY MODE
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03/25/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/800,829	<b>Applicant(s)</b> PETERSEN, NEWTON G.	
	<b>Examiner</b> DAVID J. HUISMAN	<b>Art Unit</b> 2183	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 09 January 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-45 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3, 12-19, 25-28, 34-38, 44 and 45 is/are rejected.
- 7) ☒ Claim(s) 4-11, 20-24, 29-33 and 39-43 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 January 2008 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>1/9/2008</u> .  | 6) <input type="checkbox"/> Other: _____                          |

### **DETAILED ACTION**

1. Claims 1-45 have been examined.

#### ***Papers Submitted***

2. It is hereby acknowledged that the following papers have been received and placed of record in the file: IDS and Amendment as received on 1/9/2008.

#### ***Specification***

3. The disclosure is objected to because of the following informalities:
  - Throughout the applicant, specifically on pages 1-3 and 10, applicant refers to names but it is not clear who these people are. For instance, applicant mentions at least Cahoon and McKinley, Wang et al., J.T. Buck, Wauters et al., Lee and Parks, Kahn and MacQueen (should the be McQueen?), Patt and Yeh, Buttazzo et al., and Abdelzaher et al. It is asked that applicant associate documents with these people so it is known who applicant is referring to.
    - Applicant argues that the names are authors of documents previously cited by applicant, but when looking at the specification, they just appear to be randomly inserted names. It is asked that applicant at least include the name of the publications associated with each of the authors so that the specification appears to include more than just random names.

Appropriate correction is required.

***Maintained Rejections***

4. Applicant has failed to overcome the prior art rejections set forth in the previous Office Action. Consequently, these rejections are respectfully maintained by the examiner and are copied below for applicant's convenience.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-3, 12-19, 25-28, 34-38, and 44-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weiser et al., U.S. Patent No. 5,265,213 (herein referred to as Weiser) in view of Hennessy and Patterson, "Computer Architecture - A Quantitative Approach, 2nd Edition," 1996 (herein referred to as Hennessy). Hennessy is now cited in response to applicant's challenge of the examiner's Official Notice.

7. Referring to claim 1, Weiser has taught a method for run-time prediction of a next caller of a shared functional unit (see claim 1 of Weiser, for instance, and note prediction of a call/branch/jump instruction), but Weiser has not explicitly taught that the shared functional unit is operable to be called by two or more callers out of a plurality of callers. However, Hennessy has taught, on page 711, that a shared functional unit (i.e., the lockit routine) is called by two or more callers (i.e., the bnez and beqz instructions). The examiner asserts that it is well known in the art, and herein taught by Hennessy, that multiple call/branch/jump instructions can have the

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same target. The example of Hennessy shows that the system should perform the same lockit function if either a lock is not available or if the store fails. Again, this is just a simple example of one time when such code is used. There are many situations in which this is useful, and as explained previously, such programming is well known in the art. As a result, in order to accomplish performing the same function in response to two different conditions, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Weiser in view of Hennessy such that the shared functional unit is operable to be called by two or more callers out of a plurality of callers.

b) Weiser, as modified in view of Hennessy, has further taught the method comprising:

b1) detecting a calling pattern of the plurality of callers of the shared functional unit. See the abstract and note that both history and past target address are maintained.

b2) predicting the next caller out of the plurality of callers of the shared functional unit. Again, see claim 1 and note that branch prediction occurs.

b3) loading state information associated with the next caller out of the plurality of callers. See the abstract and claim 1 and note that when a branch is predicted, its target path is loaded into the system for execution.

b4) wherein the shared functional unit and the plurality of callers are operable to execute in parallel on a parallel execution unit. See the abstract. The caller and target are executed concurrently.

8. Referring to claim 2, Weiser, as modified in view of Hennessy, has taught the method of claim 1, wherein the run-time prediction is performed for an application described by a dataflow

graph. All programs can be broken down into dataflow graphs, as data flows from independent to dependent instructions until completion.

9. Referring to claim 3, Weiser, as modified in view of Hennessy, has taught the method of claim 1. Weiser has not taught that the run-time prediction is performed for an application programmed in a dataflow language. However, dataflow languages are well known and accepted in the art and are advantageous because they are inherently parallel. Parallelism, as is known, allows for increased throughput. Consequently, in order to improve performance, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Weiser such that the run-time prediction is performed for an application programmed in a dataflow language.

10. Referring to claim 12, Weiser, as modified, has taught the method of claim 1, wherein the parallel execution unit comprises one or more of: an FPGA; a programmable hardware element; a reconfigurable logic unit; a nonconfigurable hardware element; an ASIC; a computer comprising a plurality of processors; and any other computing device capable of executing multiple threads in parallel. One could say that every hardware element is either nonconfigurable or reconfigurable. Clearly, Weiser must be one of the two (likely nonconfigurable, as there is no mention of reconfiguring it), and therefore, the claim is anticipated.

11. Referring to claim 13, Weiser, as modified, has taught the method of claim 1, wherein the state information comprises one or more of: execution state; values of any variable; previous inputs; previous outputs; and any other information related to execution of a node in a dataflow diagram. As previously discussed, when a target is predicted, the associated target instruction is

loaded into the system for execution. Clearly, an instruction makes up the execution state of the system, and therefore, the claim is anticipated.

12. Referring to claim 14, Weiser, as modified, has taught the method of claim 1, wherein the run-time prediction operates to optimize execution of the nodes in the dataflow program. Branch prediction is clearly used to optimize the program. And, since it has been deemed obvious to program in a dataflow language, then optimization occurs for execution of nodes in a dataflow program.

13. Referring to claim 15, Weiser, as modified, has taught the method of claim 1, wherein the shared functional unit and the plurality of callers are generated from a dataflow program. Again, since it has been deemed obvious to program in a dataflow language, then Weiser's functional units and callers are generated from a dataflow program.

14. Referring to claims 16, claim 16 is rejected for the same reasons set forth in the rejection of claim 1. Furthermore, note that all programs may be broadly considered dataflow programs as data flows from one instruction to the next.

15. Referring to claim 17, Weiser, as modified, has taught the method of claim 16, wherein one or more of the plurality of nodes are operable to be called by two or more nodes of the plurality of nodes. Each instruction, or each group of instructions in a program may be considered a node, and as described above, a node may have multiple callers.

16. Referring to claim 18, Weiser, as modified, has taught the method of claim 16, wherein the run-time call prediction operates to optimize execution of the nodes in the dataflow program. Branch prediction, which is performed by Weiser, is clearly used to optimize the program.

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17. Referring to claim 19, Weiser, as modified, has taught the method of claim 16.

Furthermore, claim 19 is rejected for the same reasons set forth in the rejection of claim 12.

18. Referring to claim 25, Weiser, as modified, has taught the method of claim 16, wherein the shared functional unit and the plurality of callers are generated from the dataflow program.

All instructions are generated by the program. Therefore, this is deemed to be inherent.

19. Referring to claim 26, the memory medium of claim 26 comprises instruction to perform the method of claim 1. Consequently, claim 26 is rejected for the same reasons set forth in the rejection of claim 1.

20. Referring to claim 27, Weiser, as modified, has taught the memory medium of claim 26, wherein the run-time call prediction operates to optimize execution of the nodes in the program.

Branch prediction, which is performed by Weiser, is clearly used to optimize the program.

21. Referring to claim 28, Weiser, as modified, has taught the memory medium of claim 26. Furthermore, the memory medium of claim 28 comprises instruction to perform the method of claim 12. Consequently, claim 28 is rejected for the same reasons set forth in the rejection of claim 12.

22. Referring to claim 34, Weiser, as modified, has taught the memory medium of claim 26, wherein the program comprises one or more of: program instructions; digital logic; and any type of hardware description used to configure the parallel execution unit. Programs inherently include program instructions.

23. Referring to claim 35, Weiser, as modified, has taught the memory medium of claim 26, wherein the shared functional unit and the plurality of callers are generated from the program.

All instructions are generated by the program. Therefore, this is deemed to be inherent.



24. Referring to claim 36, Weiser, as modified, has taught the memory medium of claim 26, wherein the program comprises a control and arbitration logic unit that is operable to said detect, said predict, and said load. It has already been established that Weiser performs the detecting, the predicting, and the loading. The hardware involved in those three steps is make up the “control and arbitration logic”.

25. Referring to claim 37, the system of claim 37 performs the method of claim 1. Consequently, claim 37 is rejected for the same reasons set forth in the rejection of claim 1.

26. Referring to claim 38, Weiser, as modified, has taught the system of claim 37. Furthermore, the system of claim 38 performs the method of claim 12. Consequently, claim 38 is rejected for the same reasons set forth in the rejection of claim 12.

27. Referring to claim 44, Weiser, as modified, has taught the system of claim 37, wherein the shared functional unit and the plurality of callers are generated from the dataflow program. All instructions are generated by the program. Therefore, this is deemed to be inherent.

28. Referring to claim 45, Weiser, as modified, has taught the system of claim 37, wherein the optimization algorithm is comprised on a control and arbitration logic unit that is operable to said detect, said predict, and said load. It has already been established that Weiser performs the detecting, the predicting, and the loading. The hardware involved in those three steps is make up the “control and arbitration logic”.

*Allowable Subject Matter*

29. Claims 4-11, 20-24, 29-33, and 39-43 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

*Response to Arguments*

30. Applicant's arguments filed on January 9, 2008, have been fully considered but they are not persuasive.

31. First, applicant appears to be challenging the examiner's taking of Official Notice in the rejection of claim 1. In response, the examiner has cited Hennessy and included it in the rejection of claim 1 above. Hennessy is a showing of evidence that multiple callers may call a shared functional unit.

32. Applicant argues the novelty/rejection of claim 1 on page 16 of the remarks, in substance that:

“...nowhere does Weiser teach or suggest a plurality of callers that can call a shared function unit. In contrast, Weiser only teaches a system that "employs logic which allows a branch instruction and its target instruction stored in the branch target buffer to be executed concurrently in the two execution units according to the history data stored in the branch target buffer." See Weiser Abstract. Also, the cited claim 1 of Weiser merely teaches a "branch buffer" that includes a "predicted branch target instruction" and "multiplexer means" which is operable to "direct ... instructions" as indicated by the "predicted branch target instruction" to second execution means. See claim 1 of Weiser.

Thus nowhere do the cited portions of Weiser, or Weiser in general, teach or suggest a plurality of callers that can call a shared functional unit, and instead only teach to predict branch instructions, i.e., of branches to be taken in the future, in a system with two execution units. In contrast, claim 1 is directed to a method that predicts the "next caller of a plurality of callers." Applicant respectfully notes that predicting a future branch operation as taught in Weiser is significantly different from predicting a next caller of a shared functional unit."

33. These arguments are not found persuasive for the following reasons:

a) The examiner asserts that the branch instructions in Weiser do qualify as callers. By branching to some snippet of code (function, or routine), the call upon this function to be executed. It follows then, by predicting a branch, a caller is predicted in Weiser. The shared functional unit, as described in the rejection of claim 1, is the code that is branched to by the “caller”. It is shared when multiple branches are able to branch to it, as shown in Hennessy. In general, the examiner asserts that the claims are far too broad to preclude reading a caller as a branch instruction.

### ***Conclusion***

34. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DAVID J. HUISMAN whose telephone number is (571)272-4168. The examiner can normally be reached on Monday-Friday (8:00-4:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (571) 272-4162. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/David J. Huisman/  
Primary Examiner, Art Unit 2183  
February 22, 2008